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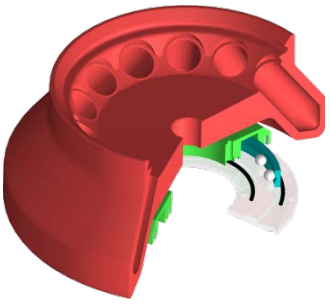
INSTITUT FÜR MECHANIK

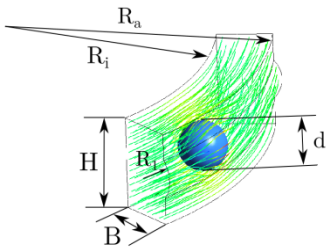
INSTITUT FÜR STRÖMUNGSTECHNIK UND THERMODYNAMIK

CFD-Analysis of the drag on balls in radial bearings in the context of automatic balancing (Master project/ Master thesis)

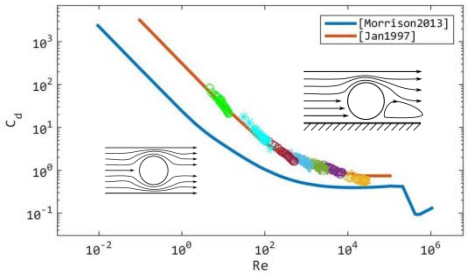
Vibrations of rapidly-spinning rotors due to imbalance in mass can lead to reduced bearing lifespan or severe damage to the system. Classical methods of rotor balancing fail for machines which deal with process-related variable unbalance positions, e.g. laboratory centrifuges. Automatic balancing devices are able to counteract the rotor imbalance autarkically with the help of free movable masses which are environed by a Newtonian fluid enclosed in an axisymmetric annulus. Disadvantageous friction between the balls and the raceway is reduced by the use of the outer ring of a radial bearing and the corresponding balls.



(1) Model of an automatic ball balancer



(2) Streamlines of the flow around a ball in the annulus



(3) Cd-Re diagram of different boundary conditions

In order to conduct simulations of the run-up process of rotors equipped with automatic ball balancers, the knowledge of the drag forces on the balls is of the essence. In comparison to spheres in contact with one flat surface, the curvature of the raceway, the concave contact surface and the annulus geometry are influencing the relation between the drag coefficient C_d and the Reynolds number Re. The aim of this project is to determine the influence of the annulus and ball design parameters on the drag coefficient.

Tasks:

- Generation of a CFD model to derive C_d-Re-relations
- Validation by modelling boundary conditions published in the literature, e.g. free flow, contact with a flat surface
- Comparison of numerical results regarding the annulus geometry to existing experimental data
- Sensibility study on the annulus and ball design parameters
- Optional: Study on the “tandem”-effect when using multiple balls

Die Bearbeitung kann auch in deutscher Sprache erfolgen.

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